

ABSTRACT

A vertical cavity surface emitting laser (VCSEL) includes a substrate; a first mirror stack over the substrate; an active region having a plurality of quantum wells over the first mirror stack; a tunnel junction over the active region, a p-layer of the tunnel junction including GaPSb or AlGaPSb; and a second mirror stack over the tunnel junction. The p-layer including GaPSb or AlGaPSb can be used to form a tunnel junction with an n-doped layer of InP or AlInAs, or with a lower bandgap material such as InGaAs, AlInGaAs or InGaAsP. Such tunnel junctions are especially useful for a long wavelength VCSEL.